

## Mini UAV activities



**HoverEye VTOL UAV**



**Fixed wings drone**



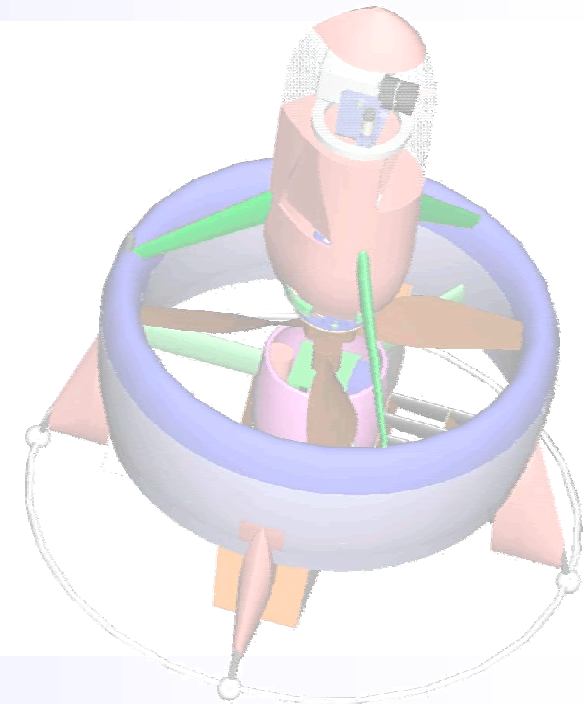
# Bertin Technologies' VTOL UAV

## HOVEREYE PRODUCT

**HoverEye**, a VTOL UAV for turbulent urban environment

- ↪ Vertical take-off and landing
- ↪ Light and compact system
- ↪ Autonomous (obstacles avoidance)
- ↪ Rapid setup, easy to use (electrical power)
- ↪ User-safe, harmless system
- ↪ Hostile environment operation (wind, urban area...)

**HoverEye**, a product developed by Bertin Technologies and protected by international patents



## MAIN CHARACTERISTICS

- |                       |        |                              |                     |
|-----------------------|--------|------------------------------|---------------------|
| ↪ External diameter : | 0,5 m  | ↪ Speed :                    | 55 km/h             |
| ↪ Height :            | 0,6 m  | ↪ Wind gust resistance up to | 55 km/h             |
| ↪ Total weight :      | 2,8 kg | ↪ Flying range :             | 2000 m in-sight     |
| ↪ Payload :           | 0,2 kg |                              | 1000 m out of sight |
| ↪ Autonomy :          | 30 min |                              |                     |



# Civil and military applications

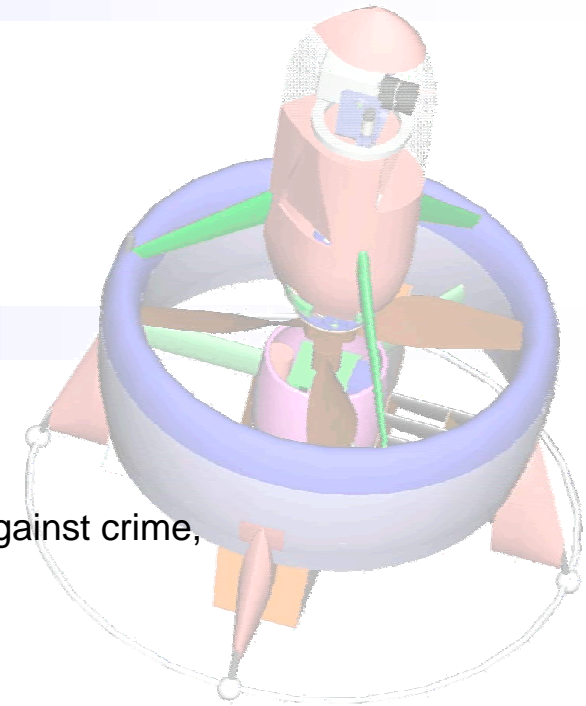
## MILITARY APPLICATIONS

The infantryman and special forces' **out of sight system** for :

- ↪ Urban environment short flight range surveillance and observation
- ↪ Law enforcement
- ↪ Urban combat assistance...

## SECURITY APPLICATIONS

- ↪ Security
  - ↪ Structures' inspection (viaduc, supporting wall, electric lines, ...)
  - ↪ Police force, Customs : sites surveillance, crowd surveillance, fight against crime, terrorism, ...
- ↪ Civil security
  - ↪ Fire prevention: dangerous areas surveillance
  - ↪ Environmental missions (collection of atmosphere samples ...)



## COMMERCIAL APPLICATIONS

- ↪ High technology toy?
- ↪ Platform for university teachers and students?

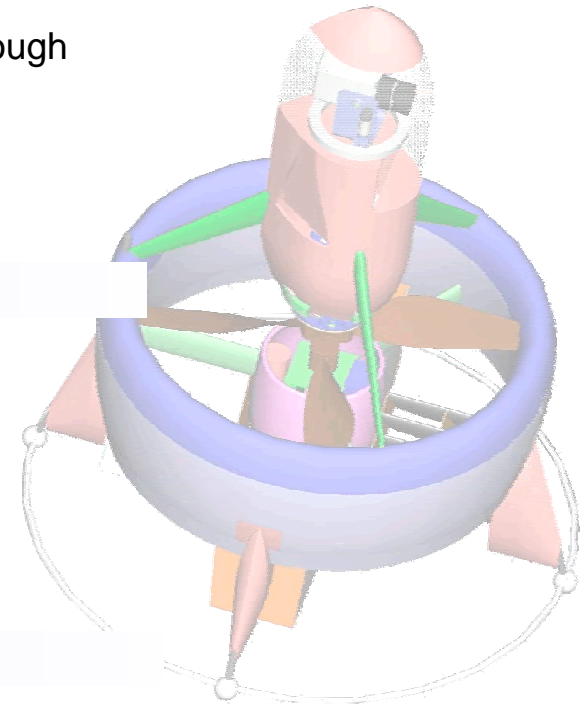


# Economic situation

Bertin Technologies has been developing its MAV activity for the past 5 years through investment and with support of public funding

## MOD CONTRACT

Bertin Technologies develops, for the MOD, a turbulent urban environment hovering flight VTOL MAV



## 1 MINISTRY OF RESEARCH FUNDING

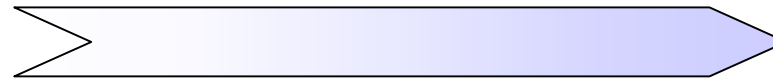
Bertin Technologies, as project manager within a consortium including research laboratories, is developing, for the Ministry of Youth, National education and Research a VTOL MAV demonstrator for structures' inspection

From « Flying ball » ...

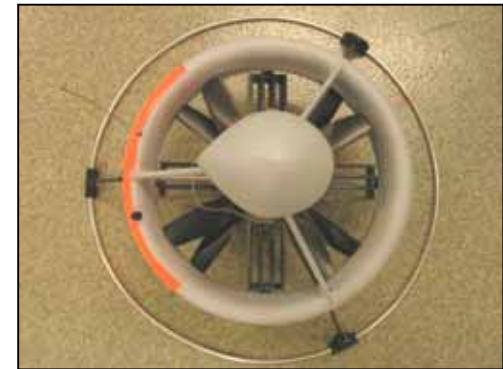
... to « HoverEye »



**Bertin Technologies innovates :**



- ↗ New aerodynamic design
- ↗ Wind tunnel detailed characterization
- ↗ Complete avionics design dedicated to MAV
- ↗ Advanced guidance, navigation, and control (GNC laws)
- ↗ Systematic design, verification and validation approach





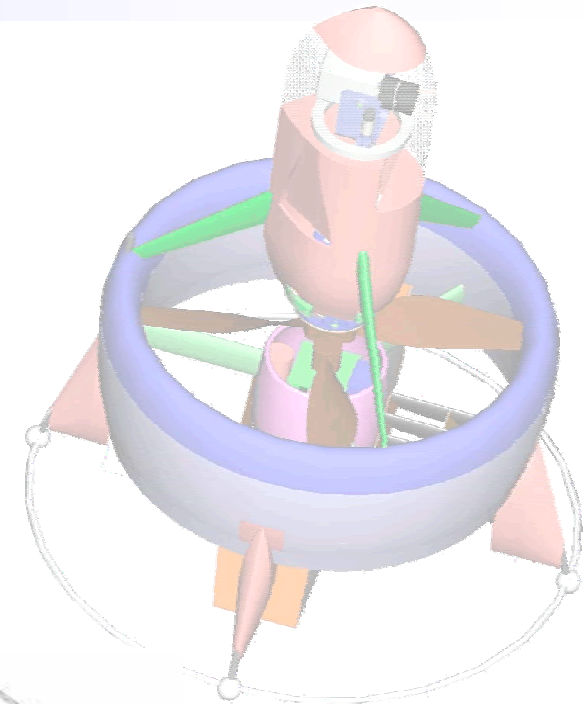
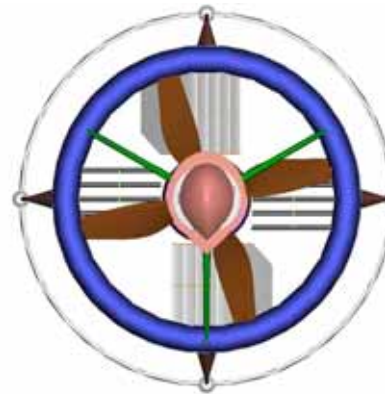
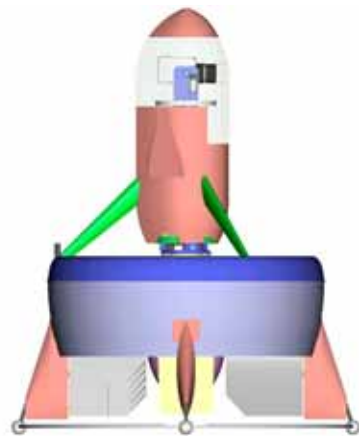
## AERODYNAMIC DESIGN MATCHES OPERATIONAL REQUIREMENTS

### Aerodynamics meets our specifications:

- ↪ hover flight and forward flight up to 55 km/h (cruise speed)
- ↪ wind gusts up to 55 km/h
- ↪ reduced energy consumption

### Internal volume with integration of:

- ↪ Energy unit,
- ↪ Propulsive unit,
- ↪ Avionics sensing unit,
- ↪ Payload.





# Bertin Technologies' innovations

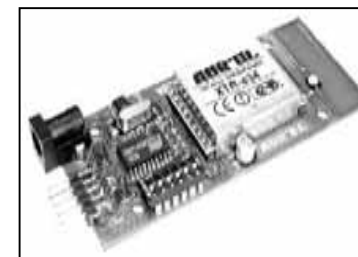
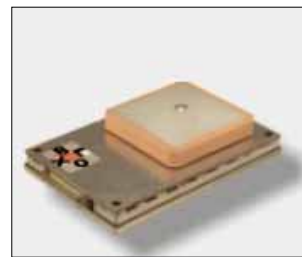
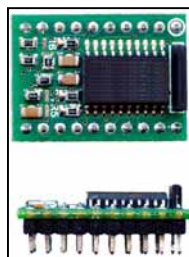
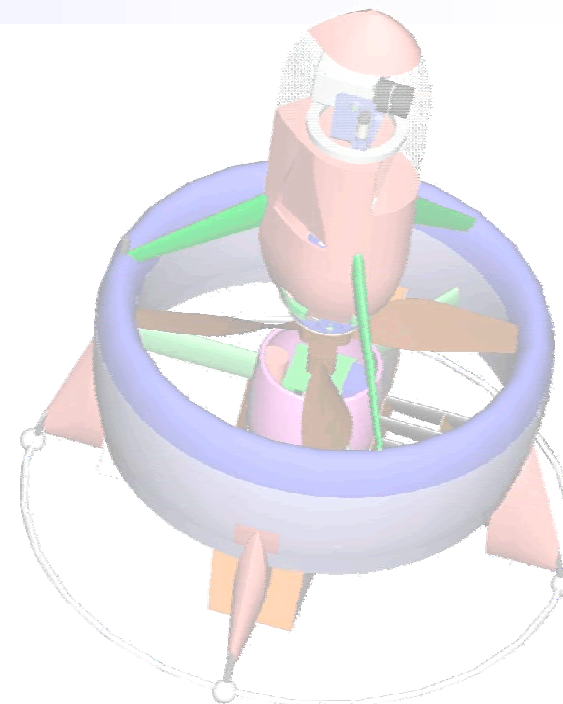
## WIND TUNNEL ARCHITECTURE CHARACTERISATION

- ↪ Low speed wind tunnel measure campaigns
- ↪ High-performance measurements
- ↪ Results:
  - ↪ Vehicle characterization in the whole flight envelop
  - ↪ Input data for full flight simulation



## DESIGN OF COMPLETE AVIONICS DEDICATED TO MAV

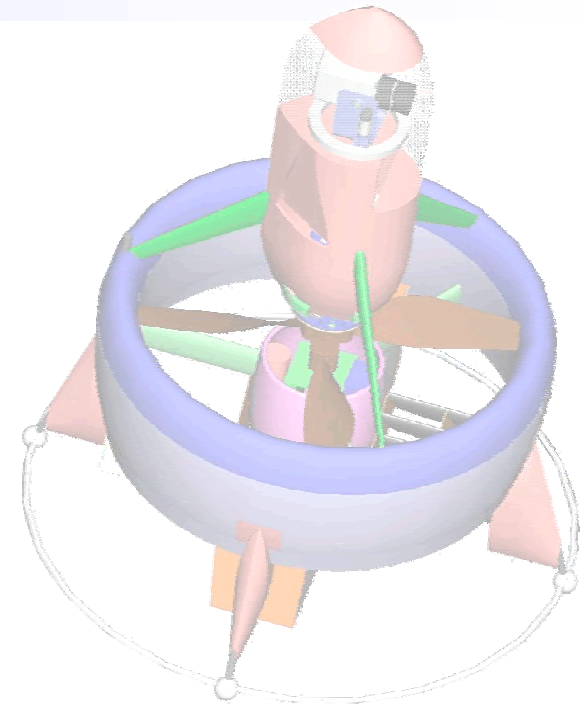
- ↪ Design and manufacturing of multiprocessor electronics with high-computing capacity
- ↪ Sensors for external environment:
  - ↪ Latest generation attitude sensors,
  - ↪ altitude sensors,
  - ↪ position sensors,
  - ↪ temperature, power consumption internal sensors,
- ↪ Sensors for internal environment:
  - ↪ obstacle detection sensors
  - ↪ vision sensors





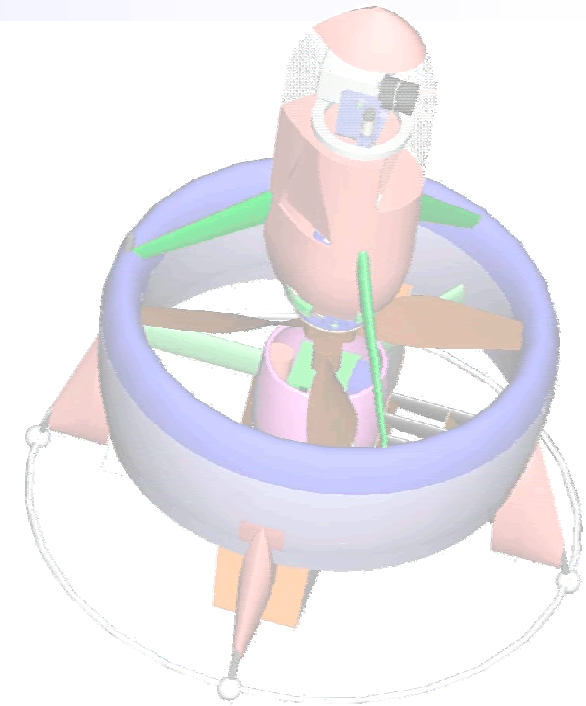
## ADVANCED GNC

- ↪ Sensors fusion for localization and navigation, for example estimate of:
  - ↪ attitude,
  - ↪ position,
  - ↪ displacement speed....
  
- ↪ Stabilization laws dedicated to flight in gusting wind
  
- ↪ Waypoint navigation
  
- ↪ Autonomous flight modes (take-off, landing, obstacle avoidance)
  
- ↪ Failure modes management



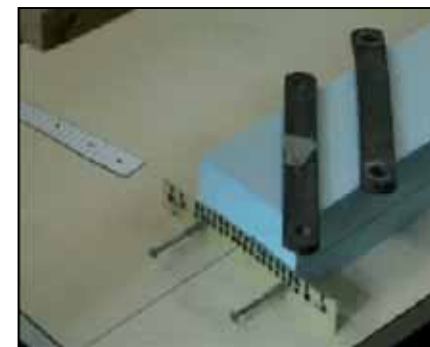
## SIMULATION AND REAL-TIME CODE GENERATION TOOLS

- ↪ Design of a full nonlinear 6 DoF flight simulator coupled with a of virtual reality simulation tool
- ↪ Automatic real-time codes generation tools



## RAPID PROTOTYPE METHODS AND NUMEROUS TEST FLIGHTS

- ↪ Up to now: 3 VTOL MAV prototypes type HoverEye have been designed, others are being manufactured
- ↪ More than a hundred test flights:
  - ↪ with different type of control / command laws
  - ↪ with different avionics (from the simplest to the most sophisticated)



Hovering flight



Pitch rotation exercise



Yaw rotation exercise



Coordinated turn

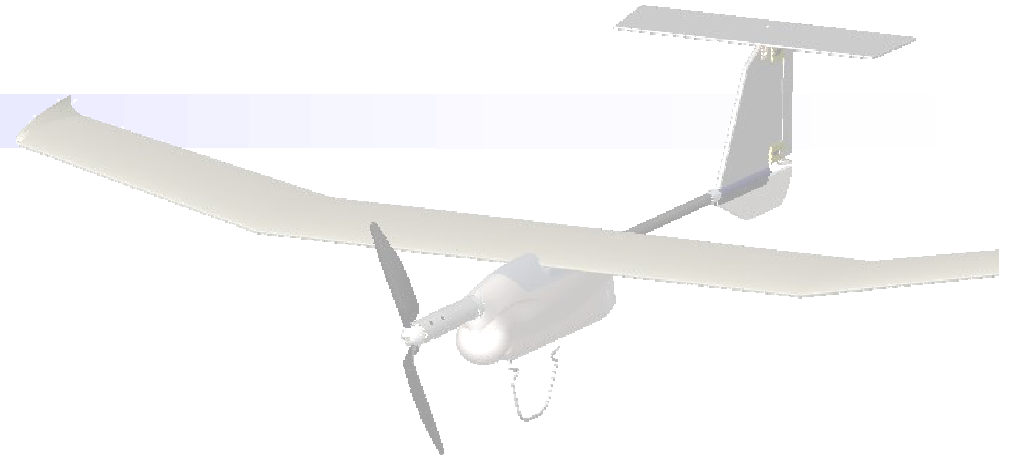


# EMT - Bertin's fixed wind MAV

Bertin Technologies associated with German industrial EMT to propose an automatic fixed-wing MAV for

## THE PRODUCT

- ↻ Hand launch
- ↻ Vertical automatic recovery (landing)
- ↻ Reduced transport dimensions, fast and easy mounting
- ↻ Great autonomy
- ↻ Fast and easy setting in action (electric power)
- ↻ Hostile environment functioning (wind)



## MAIN CHARACTERISTICS

↻ Wing span:	2 m	↻ Autonomy:	50 min
↻ Length:	1,5 m	↻ Speed:	110 km/h
↻ Total weight:	4,6 kg	↻ Operating range:	> 7 km

# Historique des évolutions

Indice	Date	Modifications	Rédacteur / Vérificateur
A	01/09/04	Creation in French	Brossay / Philippe
B	07/09/04	English translation	Souverain / Renouil